

Progress, Plans/Priorities, Issues

JCSDA Workshop

Land Session

01-02 May 2007

Changing focus of Land Arena of JCSDA:

- **Early work focused on deriving new satellite-based global land surface characteristics**
 - albedo, landuse class, vegetation phenology
- **New work will focus on:**
 - **1) Impact of above land datasets in models**
 - especially in global models
 - **2) Reducing large differences between simulated and observed satellite Tb for sfc-sensitive channels**
 - Improve physics of modeled land surface skin temperature
 - Aerodynamic and canopy resistance
 - Surface emissivity
 - **3) Actual land 4dda of satellite-based snow and soil moisture estimates**
 - Kalman filters in NASA LIS system
 - Rescaling satellite soil moisture to that of model

Progress Highlights: Previous Year

- **X. Zeng (U. Arizona):**
 - An Algorithm for Green Vegetation Fraction and Its Impact in coupled WRF/land mesoscale NWP testing
 - New MODIS-based algorithm to retrieve green vegetation fraction (GVF)
 - **GVF difference does produce large precipitation difference from WRF**
- **C. Peters-Lidard (NASA/HSB, NASA/GMAO, NCEP/EMC, AFWA):**
 - Recent Developments and Enhancements in Land Information System Testbed LIS)
 - New LIS 5.0 has tested Ensemble Kalman
 - **LIS coupled with WRF for mesoscale NWP impact assessment**
- **P. Houser (CREW):**
 - Assimilation of AMSR-E Land Products into the Noah LSM
 - **Ensemble Kalman filter assimilation of AMSR-E soil moisture in LIS/Noah tested**
 - Rescaling / Bias correction procedure tested
- **E. Wood/D. Lettenmaier (Princeton U. & U. Washington):**
 - Development of Improved Forward Snow Microwave Emission Models
 - DMRT, LSMEM and CRTM MW emission are tested (future: possibly incorporated into CRTM)
 - Evaluated model error sensitivity with forest cover and errors in snow parameters
- **F. Chen / D. Niyogi (NCAR, Princeton U):**
 - For Integrating satellite-based vegetation products: improve the representation of vegetation and transpiration processes in the Noah LSM
 - New Noah-GEM capability for transpiration tested (Ball-Berry in place of Jarvis)
 - Noah-GEM produces difference simulations from those of Noah-Jarvis
- **M. Friedl (Boston U):**
 - Derive MODIS-based global hi-res land surface fields (landuse, albedo, LAI)
 - **LAI: delivered MODIS-based monthly global 5-km fields of LAI**

Progress Highlights (Con't): Previous Year

- **K. Mitchell / H. Wei (NCEP/EMC)**
 - Test impact of new JCSDA-sponsored global land sfc fields in NCEP global model (done: albedo, next: vegetation, surface emissivity)
 - **Boston U and U. Arizona MODIS albedo fields has positive impact on global model 5-day forecast skill**
- **S. Liang (U. Maryland) – new start**
 - Land Surface Thermal Infrared Emissivity Modeling for Operational Weather Prediction and Climate Models
 - New emissivity expected to have significant impacts on model sfc temp & fluxes
 - Test/develop for physical and empirical sfc emissivity models
- **X. Zhan (NESDIS/STAR):**
 - Improvement of Satellite Soil Moisture Data Products and their Assimilation into Numerical Weather Prediction Model
 - Alternative SM data will be produced from AMSR-E/WindSat
 - EnKF to be implemented in NCEP global model & impact to be assessed
- **D. Tarpley / L. Jiang (NESDIS/STAR):**
 - Progress on AVHRR-Based Global Vegetation Processing System (GVPS) and Products
 - Remove false temporal trend from NDVI and green veg fraction products
 - Weekly realtime global product and 25-year climatology
 - Their impact on NWP is to be assessed

Land 4dda: Lessons/Issues learned so far

- **AMSR-E soil moisture quality**
 - Lack of dynamic range in “official” NASA product
 - Consider alternative retrieval products
 - Explore use of 6 GHz channel
 - Apply/refine rescaling of product
 - PDF/CDF approach
 - Other “rescaling” approaches
 - » Bias correction
 - » Standard normal deviate
 - » Regional or global application
 - Lack of ground truth
 - » Rescale to given land model in global or regional coupled model
 - Realtime requirement must influence rescaling approach
- **Soil moisture retrievals from other satellite sensors**
 - SMOS, ASCAT, ERS-1/2 (ESCAT)
- **Assimilation of other land surface fields**
 - Skin temperature and sub-surface temperature
 - Snow cover fraction
 - Snowpack water content (SWE)
 - Vegetation density/cover (e.g. LAI)

Land 4dda: Lessons/Issues learned so far

- **LIS: Growing need for NASA Land Information System (LIS) applications/use among JCSDA Land PIs**
- **LIS Land 4dda infrastructure expansion needs/plans**
 - For public use
 - Aug 07 release of LIS Version 5.0
 - **Support for Ensemble Kalman filter and other sequential 4dda options**
 - **Support for CRTM applications in LIS**
 - **Using LIS with CRTM as land sfc lower boundary condition for forward radiative transfer**
 - **Ingest of 3-D atmospheric state**
 - Direct assimilation of satellite brightness temperature (Tb)
 - Internal NASA-NCEP collaboration to couple LIS to NCEP and NASA global models via ESMF
 - NASA-NCAR collaboration to couple LIS to WRF via ESMF
 - Dynamic/online bias correction options to apply to assimilated product

Land 4dda: Lessons/Issues at present

- **CRTM: land surface needs**
 - Unify states, parameters and land/vegetation categories between land model and CRTM
 - Tighter communication between land model and CRTM
 - Cast CRTM in ESMF framework?
 - Working group between land modelers and CRTM surface-module developers
 - Surface emissivity module

Land 4dda: Lessons/Issues learned so far

- **Physics extensions needed in land models for land 4dda**
 - Dynamic vegetation
 - Additional snow states:
 - Snow grain size
 - Multi-layer snowpack treatments
 - Canopy interception of snow
 - Physical treatments of snow cover fraction
 - Snow redistribution: blowing snow
 - Thinner top soil layer
 - Inland lakes and wetlands
 - Groundwater state
 - Separate canopy, soil, snowpack surface temperature